

Growing garden tomatoes



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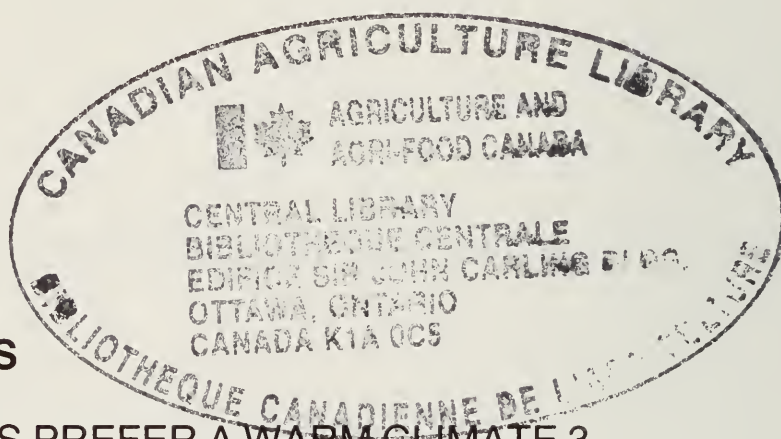
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GROWING GARDEN TOMATOES

Calvin Chong¹

The tomato is probably our most popular garden vegetable. Even in the smallest garden, there is always room for a few tomato plants. The tomato is easy to grow and is adapted to a wide variety of soil and garden conditions. Originating in tropical America, it is an herbaceous perennial botanically related to the potato, pepper and eggplant. In temperature climates, where the tomato is grown outdoors, it is killed by frost before completing the first year's growth. In 16th century Europe, it was known as the "Love Apple".

This publication outlines some of the essentials in growing better garden tomatoes. It should be realized that all varieties of tomato cannot be treated alike. Cultural practices and choice of varieties vary greatly from locality to locality, and also according to availability and personal preferences. It is not possible to include details applicable to all situations.

Tomatoes prefer a warm climate

Often failure or poor cropping of tomatoes is blamed on the variety or seed planted, but it should be remembered that no one variety is capable of producing good crops under all conditions. The tomato requires a long, warm season of 3½ to 4 months to complete the cycle from seed to first mature fruits (Figure 1).

In our northern temperate climate, tomatoes are not usually successful if seeded outdoors. Seeds of most varieties do not germinate satisfactorily in cold soil. At 10°C, tomato seeds come up in 25 to 30 days compared with 4 to 5 days at 29°C. Although certain varieties of processing tomatoes are grown directly from seed in milder areas of southwestern Ontario, direct seeding is not recommended in home plantings. In most parts of Canada, only early and mid-season varieties started from plants set out in the garden after danger of frost is past, will ripen a satisfactory crop.

Growth of tomato plants is best under uniformly moderate temperatures of between 18° and 29°C. Depending on length or severity of exposure to chilling, the plants may be temporarily or seriously impaired by temperatures below 10°C. Exposures to chilling temperatures have a cumulative effect. Chilled plants may develop a purple coloration in stem and leaf veins, with possible subsequent stunting of plant growth and poor

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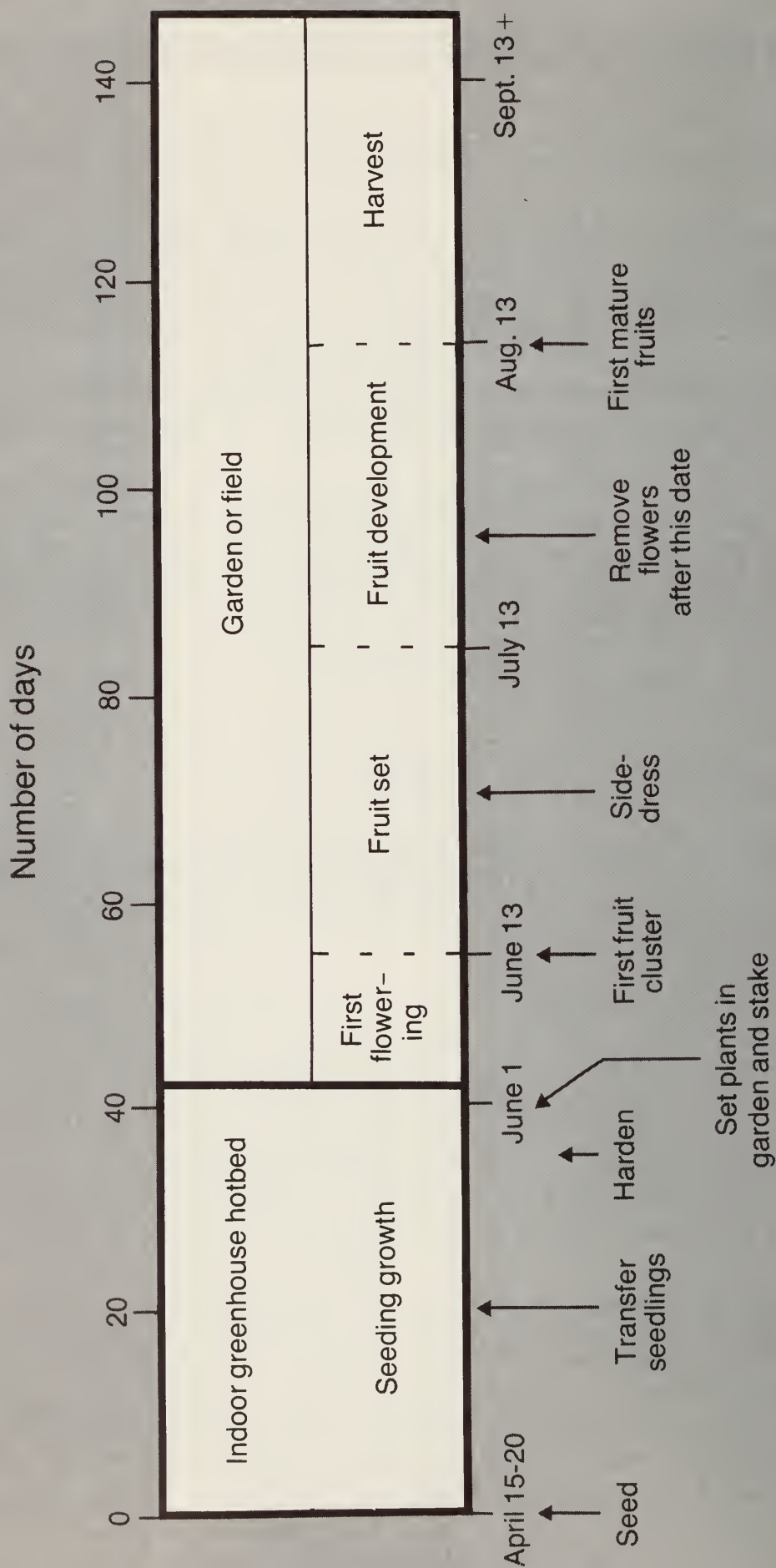


Figure 1 — Growth and development of a typical garden tomato plant.

yield. If chilling is not serious, plants gradually lose the purple coloration and recover fully. Quite often, malformation of fruits — usually on the first cluster — is caused by low night temperatures at flowering and pollination time.

Tomato plants continually flower and set fruits, unless growth is checked by disease or frost. Flowering normally occurs within 12 days after garden planting, with the first cluster of fruits setting a few days later (Figure 1). A tomato fruit requires about 60 days from the beginning of fruit set to maturity. Depending on variety and management, five clusters of fruit per plant can be expected to ripen during the harvest season. Each cluster usually yields 500 to 750 g of tomatoes, or 2.25 to 3.20 kg per plant. Early varieties tend to bear fruit over a shorter period of time than late varieties.

Choose a good variety

The wide choice of shapes, sizes and colors of tomato varieties often overwhelms home gardeners. It is important to choose varieties well adapted to local growing conditions, such as those already known for performance in your district. Tomato varieties described in catalogues of nurseries or seed houses located in Canada, or tomato seeds and transplants sold by local garden stores, usually produce a satisfactory crop. Although most gardeners grow the common red varieties, pink or rose tomatoes are popular in Quebec. Yellow and cherry tomatoes are often grown by garden enthusiasts.

Determinate and Indeterminate Types

There are two distinct types of tomatoes — determinate and indeterminate. These types differ in various ways and each requires special cultural care for best results. Determinate varieties are 'self-topping', that is, the growing point of the plant terminates in a flower cluster. The plants are generally smaller and bushier than those of indeterminate types, are often earlier maturing, and do not require staking and pruning. Fruit size averages 85 to 110 g. Determinate varieties are usually preferred by commercial enterprises. Indeterminate varieties are capable of growing and setting fruits indefinitely. Although some are late-maturing, they are popular with home gardeners because they often produce large, superior quality fruits, weighing 170 to 225 g or more — excellent for use in sandwiches. Indeterminate varieties require less space per plant than determinate varieties and should be staked and pruned for best results.

Varieties listed in seed catalogues are not always described as 'determinate' or 'indeterminate'. Therefore the following list of words and phrases frequently used to describe both types may be of interest:

Characteristics	Determinate Type	Indeterminate Type
Plant habit	<ul style="list-style-type: none"> - smaller or compact - bushy; bush type; self-topping; does not run to vine 	<ul style="list-style-type: none"> - larger plants; large- plants; small- vined vined; heavier vined - vigorous; very vigorous - continuous bearer; sets fruits indefinitely
Earliness or	<ul style="list-style-type: none"> - early crop variety; extra early; extremely or very early; outstanding for earliness - short season type; or other early varieties; rates with the earliest of varieties - fruit set at low temperatures; sets fruits early - matures about 50 to 65 days from transplanting 	<ul style="list-style-type: none"> - late variety; late maturity early cropping; maturing type - main cropping; main as early as Fireball crop variety - matures about 65 to 85 days from transplanting
Culture and adaptation	<ul style="list-style-type: none"> - free-standing or nonstaking type; does not require staking or pruning - can be direct seeded; can be seeded outdoors; germinates in cold soil; adapted for a short-season location - adapted for mechanical harvesting - canning or processing variety; suitable for canner trade 	<ul style="list-style-type: none"> - staking type; for staking and pruning; fall staking type; staked bush form; trellis type; suckers should be removed - greenhouse or forcing type
Fruit size	<ul style="list-style-type: none"> - small or small fruited; average size 85 to 110 g 	<ul style="list-style-type: none"> - large or extra large-fruited; jumbo or giant size; 170 to 225 g or more; beefsteak type

Varieties classed as semi-determinate are intermediate in characteristics and can be grown either staked or unstaked. However, because of our short growing season such varieties normally are best handled like determinate types. Consult your nearest agricultural extension specialist or research station for information on new and better adapted varieties.

Start with vigorous plants

It is usually more practical and less costly for the home gardener to buy greenhouse-grown tomato seedlings from garden stores than to grow plants from seed. For best results, select stocky, medium-green, vigorous plants between 18 to 23 cm tall (Figure 2). If, on the other hand, you can provide proper lighting and temperatures, you may wish to grow your own seedlings indoors or in a hotbed.

Figure 2 — Tomato plants at proper stage of growth for planting in garden.



How to Grow Your Own Tomato Plants

Start seeds in a flat or other shallow container provided with holes for drainage 6 to 7 weeks before planned garden planting. Seedlings started too early may begin to set fruit before planting time. When set in the garden, such plants make a slow start and yield poorly. Sow at the rate of 10 to 20 seeds per 5 cm, in rows 5 to 7.5 cm apart and to a depth of 6 to 12 mm.

To control seedling diseases, use seeds that have been treated with a fungicide and plant in a sterile or near-sterile medium, such as a 1:1 mixture of peat moss and sand. To reduce drying out of the soil surface, cover the flat with newspaper which should be removed as soon as the seedlings start to emerge from the soil.

Tomato seeds germinate best between 21° and 29°C and usually come up in 4 to 7 days. Although exposure to light is not necessary for germination, as soon as the seeds come up, give them as much sunlight or artificial light as possible and keep the temperature between 16 and 24°C. Keep the soil moist to maintain steady growth. To avoid damping-off diseases of young seedlings, do not allow soil to become and stay overly wet. Transfer seedlings into small pots, preferably 6 to 7.5 cm square peat pots, when the first true leaf appears between the cotyledon leaves, about 3 weeks after seeding. Discard weak plants. If only a few plants are needed, it is perhaps easier to sow several seeds directly into each peat pot, and thin back to the most vigorous seedling after germination. Do not crowd seedlings; in flats, allow between 100 to 130 cm² of space per plant. Fertilize during waterings with a soluble complete fertilizer, that is, one containing nitrogen, phosphorus and potash, such as 10-10-10 or 10-20-20. Mix at the rate of 1 to 2 mL/5 L of water. It is better to underfeed if lighting is poor, since excessive nitrogen causes lush, 'leggy' growth. Stunting or plant injury may result from severe overfertilization.

The kitchen window sill, a favorite spot, may give adequate sunlight to seedlings if it faces south, but remember that high temperatures of 27°C or more may promote 'leggy' growth. Pinch back the growing tips, if your plants show signs of becoming spindly. Supplemental light from fluorescent lamps, particularly in combination with ordinary incandescent bulbs, promotes good growth. Seedlings should not be subjected to more than 16 hours of light a day, however, as continuous light may cause injury.

Harden Plants Before Setting in Garden

One week before plants are to be set in the garden, begin the process of hardening or gradually checking their growth by reducing temperature

to about 16°C or withholding fertilizer or keeping the plants slightly on the dry side. Any treatment that checks growth of the plants results in hardening. Gradual exposure to outdoor conditions is very good practice. Hardening enables tomato plants to withstand unfavorable environmental conditions, such as excessive wind or cool temperatures. Severe hardening is harmful because plants may never completely recover their vigor.

Transplanting

Plant on Good, Fertile Soil

The tomato plant is adapted to a wide variety of soils but unless well supplied with plant food, it yields poorly. Organic matter such as well-rotted manure or compost improves the physical structure of the soil. A good garden soil should always contain a liberal supply of organic matter. Its value, particularly in sandy and clay soils, cannot be overemphasized.

It is difficult to make specific recommendations for fertilizer applications at the time of soil preparation. Requirements vary widely, depending on the initial fertility of the soil and the richness, and amount of added manure or compost. Application of 140 mL per plant, or 12.2 kg/100 m² of a complete fertilizer such as 5-10-10, 10-10-10 or 6-12-12 should give good results. Work fertilizer thoroughly into the soil well before planting.

Sometimes a side dressing of 1 to 2 tablespoons of a fertilizer high in nitrogen (such as 33-0-0) is applied when the first fruits are 2.5 cm in diameter. Sprinkle the fertilizer in a small circle around each plant, taking care to avoid burning plants and roots. On poor or sandy soil, repeat this procedure one or twice at 2-week intervals.

Fertile sandy loam is preferable to a heavier soil. Light sandy soils warm up faster in the spring. Good air drainage afforded by a slope protects against late spring frosts, but irrigation may be necessary. Avoid planting sites lower in elevation than surrounding areas as they are frost pockets. Tomatoes do not thrive in shaded areas.

Apply Starter Fertilizer

At planting, apply a starter fertilizer solution to the plants. Starter solutions contain a water-soluble fertilizer, such as 10-52-17 or 10-52-10. Mix starter solutions at the rate of 20 to 40 mL/5 L of water and apply 300 mL of

this solution per plant. Starter solutions are high in phosphorus content, but also contain some nitrogen and potash. Phosphorus promotes rapid root growth and hastens fruit production and maturity. Many starter formulations are available under brand names with directions for use.

Set Plants When No Risk of Frost

Set tomato plants in the garden when there is no risk of frost, towards the end of May or beginning of June in most parts of Canada. Tomatoes can be set out earlier if planted in a sheltered area or otherwise protected. For emergency frost protection, cover plants with newspaper or plastic sheets, cardboard boxes or baskets at night and remove during the day. However, little is gained by planting too early because air and soil temperatures are generally too cold for good growth.

Set plants that are in peat pots directly into the soil without removing pots. To allow the roots to spread, punch holes in the sides or bottom of each peat pot or simply remove the bottom before planting. Plant in a hole slightly larger than the pot, so that the main stem is at least 5 cm deeper in the soil than it was originally. Set leggy, tall (over 25 cm) plants even deeper or bury the stems in a sloping position, leaving only the top 13 to 15 cm above the ground. Press the soil firmly around each plant.

Before setting out plants grown in plastic, clay or paper pots, remove the pots without disturbing the roots. To remove plants from flats, use a trowel and take care to leave as much soil as possible attached to the roots of each plant. Although bare-rooted tomato plants pulled from flats can withstand transplanting, plants with intact or undisturbed root systems grow more rapidly after setting and may produce fruits earlier.

Dry soils and hot weather are unfavorable for planting tomatoes. Do not let plants wilt during the process. If weather is hot or sunny, it is best to plant in late afternoon or evening.

Space Closely for Large Yields

Spacing of tomato plants depends on the variety, soil fertility, and whether or not plants are to be staked. Free-standing or unstaked determinate tomatoes require a spacing of 1 m² per plant. Staked tomatoes require much less space. As a guide, space unstaked determinate tomatoes 75 cm apart in rows 90 to 120 cm apart and staked tomatoes 45 cm apart in rows 60 to 90 cm apart. Plant dwarf tomatoes 30 cm apart. To obtain maximum tomato production in a small garden space, it is better to stake and grow a number of plants close together than to grow a few plants at wider spacings. For table use, it is suggested that you grow three plants for each person. Grow twice as many plants for canning.

Cultivation and care

Keep Weeds Under Control

Weeds compete with tomato plants for water, nutrients and sunlight, especially during early growth. Weeds also harbor insects and diseases. Home plantings are usually too small to make weeding by herbicides worthwhile, and because of the mixture of crops selective chemicals are not practical. Keep the area around tomatoes free of weeds by shallow cultivation of less than 5 cm deep, with a hoe or hand cultivator. Since most of feeding roots develop near the soil surface, whenever possible, remove weeds by hand. As the plants grow, cultivate progressively shallower and farther away from them to avoid root injury, and stop cultivating when the tops cover the ground.

Mulches

Mulches of old leaves, straw, old newspapers or synthetic materials, such as strips of black polyethylene film or aluminum foil, help to control weeds (Figure 3). Work the fertilizer thoroughly into the soil before laying synthetic mulches. Organic mulches should be applied about mid-June in a layer 5 to 10 cm deep after a light cultivation. As added benefits, mulches moderate the soil temperature, reduce evaporation, prevent erosion, reduce incidence of fruit rots, keep the fruits clean (Figure 4), and may increase yield or early maturity of tomatoes.

Figure 3 — Tomato plants growing on aluminum foil mulch. Foil strip (partial view) was anchored in furrows along each edge, leaving about 60 cm of exposed mulch over row. Circular slits were cut in mulch strip before planting.





Figure 4 — Tomatoes respond well to mulching. Fruits lying on mulch (center) are cleaner and less susceptible to rotting than those lying on soil (lower right).

Tomatoes Require Plenty of Water

Tomatoes need an adequate supply of water for vigorous, uniform growth. Moisture also assures the availability of soil nutrients. In a dry year, inadequate soil moisture upsets the calcium nutrition of tomato plants and tends to cause a greater incidence of blossom-end rot, a brown water-soaked area that gradually develops into a black, sunken scar on the lower end of the tomato. Fruits also tend to be smaller in a dry year.

A uniform supply of moisture is particularly important at the time young fruits are developing on the first flower cluster. In a wet year, there is a greater incidence of uneven or blotchy ripening, growth cracking, fungal diseases, and rotting of fruits, particularly those in contact with the soil. Susceptibility of tomato fruits to cracking largely depends on the variety.

As a general guide, tomato plants should receive 2.5 cm of water per week. If there is no rainfall for a week, water plants thoroughly. Heavy soakings at weekly intervals are better than several light sprinklings. Sandy soils need to be watered more often than clay and other heavy soils. Do not wet foliage any more than necessary.

Staked Tomatoes Need Care

Most gardeners seem to prefer staked tomatoes rather than free-standing varieties, as they grow in a smaller area and are more suitable where space is limited. Staked plants are easier to cultivate and harvest, and the fruits are cleaner and free of ground roots. However, staked toma-

atoes tend to suffer greater losses of fruit from blossom-end rot, sunburn and cracking, and they require more hand labor for proper training.

Staking and pruning to a single stem is the most common training method. Preferably at the time of transplanting, place a stick, broom handle or wooden stake (2.5 x 2.5 x 150 cm) several centimetres from the plant, and push it deep into the soil. As the plant grows, use soft twine, rag or old stocking to tie the main stem to the stake but not tightly against it (Figure 5).

Prune tomatoes by snapping off small side shoots as they develop, where the leaf stems join the main stem (Figure 5). Flower clusters arise directly from the stem. To prevent development of fruits that will not mature within the harvest season, remove all flower clusters forming after the end of July, or less than 60 days before the anticipated date of first frost in the fall (Figure 1). This conserves food manufactured by the plant for fruits already set. The common practice of removing the tip of the plant when it reaches the top of the stake may not be of any advantage, since tip removal may limit the plant's leaf area.

Figure 5 — Tomato plant supported by wooden stake. Prune off small side shoots as they develop. Tie main stem loosely to stake as shown.



Control Diseases and Pests

Diseases of tomatoes are caused by fungi, bacteria, viruses, and unfavorable soil and climatic conditions. These diseases and their control measures are described in Agriculture Canada Publication 1479, Tomato Diseases.

The best approach to disease and pest prevention in a home garden is rotation. If there is a choice, move the tomato area so that the same spot is planted only once every 2 or 3 years. Related crops, such as potatoes, peppers and petunias, should not be planted in the area during the off-years. If they are available, plant varieties that are resistant to the wilt diseases. High humidity, frequent rainshowers and heavy dew combined with warm temperatures favor the development of foliage disease, particularly in the last half of the growing season when diseases can spread very rapidly.

The cutworm is often a serious pest of tomatoes in home gardens. At the soil level, the cutworm eats through the stems of newly set plants and kills them. To prevent cutworm damage, wrap a piece of aluminum foil or tie a piece of newspaper or cardboard around the main stem of each tomato plant at the time of planting; or use chemical control. Less-injurious insects, particularly flea beetles, potato beetles, aphids, tomato hornworm, cabbage loopers, and tent caterpillars may be troublesome in certain localities. Handpick caterpillars from tomato plants whenever possible.

If infestations get out of hand, use a brand-name, home garden spray or dust mixtures to control diseases and insects on tomatoes. Do not water or spray tomatoes with a spray can that was used to apply 2,4-D, 2,4,5-T or related weed killers, since traces of these chemicals are extremely difficult to wash away. Tomatoes are very susceptible to injury by these chemicals, even from spray or vapor drifts that may come from roadside spraying, or spraying of neighbors' lawns.

For further advice on disease and pest control, or other causes of crop failure, consult your nearest agricultural representative or provincial specialist.

Harvesting

Pick When Fully Ripe

Pick tomatoes when fully ripe for best flavor, color and texture. Vine-ripened tomatoes store well for several weeks in the refrigerator. In the fall, harvest all ripe and mature green tomatoes before a predicted heavy frost. Fruit ripening and quality is strongly influenced by temperature. Mature green or turning tomatoes can be ripened satisfactorily indoors at temperatures between 16° and 20°C, although flavor of these tomatoes is not usually as good as that of vine-ripened fruits. Slower ripening at the lower temperature range favors firmer flesh. Select only the best fruits for ripening and use the others in relishes or other mixtures.

Exposure of fruits to cool or chilling temperatures has a cumulative effect. Chilling injury is not detectable at the time of picking, but later manifests itself in poor-quality fruits. The skin of tomato fruits progressively exposed to the cool nights of early fall gradually starts to break down. Hence, fruits harvested during this period do not keep well and are very susceptible to rotting. Mature green tomatoes are more sensitive to chilling injury than partly ripened fruits. Do not store mature green tomatoes in the refrigerator, since these tend to decay rapidly when later allowed to ripen at room temperature.

How to Collect and Store Homegrown Seeds

If you want to save homegrown tomato seeds for next year's planting, simply cut open the mature fruit, squeeze the pulp and seeds into a glass or plastic jar and allow to stand at room temperature for 36 to 48 hours. Fungal or mold growth appearing on the surface of the pulp is a normal part of the seed separation process. Place pulp and seeds in a strainer and run tap water through. The pulp will wash through and the seeds will remain in the strainer. Spread seeds out and dry thoroughly, as wet seeds will start to germinate. Thirty grams of seeds should contain between 7,000 and 15,000 seeds.

If kept dry and stored in a cool place, tomato seeds remain viable for several years and will germinate satisfactorily. For hybrid varieties, new seeds must be obtained each year because plants produced from seeds of hybrids will not be true to type.

Disease control begins with the seed and most commercial seed has already been treated. Before planting home-grown seeds, it is advisable to dust with thiram powder to protect against various surface seed-borne diseases.

Tomatoes are nutritious

A most versatile mealtime treat, the tomato has a high nutritional rating. Because of its low carbohydrate and high mineral and vitamin content, its composition conforms perfectly with current ideas on proper nutrition. The composition¹ of tomatoes per 100 grams of edible raw portion includes: water 93 grams; food energy 22 calories; protein 1.1 grams; fat 0.2 gram; carbohydrate 4.7 grams; fiber 0.5 gram; ash 0.5 gram; calcium 13 milligrams; phosphorus 27 milligrams; iron 0.5 milligram; sodium 3 milligrams; potassium 244 milligrams; magnesium 14 milligrams; vitamin A 900 International Units; thiamine 0.06 milligram; riboflavin 0.04 milligram; and niacin 0.7 milligram.

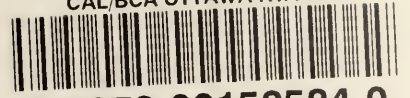
In comparison with oranges and sweet peppers, which contain respectively 3 and 10 times more vitamin C (ascorbic acid), the tomato can be considered no more than a fair source of vitamin C, which varies from 13 to 20 milligrams per 100 grams. Tiny wild tomatoes, which are grown mainly for curiosity, have a much higher ascorbic acid content (45 to 50 milligrams per 100 grams) than cultivated types. Dry, sunny weather favors high ascorbic acid. Tomatoes retain ascorbic acid well, both at room temperatures and in the refrigerator, where they can be stored up to 3 weeks, without any appreciable loss.

¹ Magoon, C.E., 1969, Tomatoes, Fruit & Vegetable Facts & Pointers, Washington, D.C.

CONVERSION FACTORS

Metric units	Approximate conversion factors	Results in:
LINEAR		
millimetre (mm)	x 0.04	inch
centimetre (cm)	x 0.39	inch
metre (m)	x 3.28	feet
kilometre (km)	x 0.62	mile
AREA		
square centimetre (cm ²)	x 0.15	square inch
square metre (m ²)	x 1.2	square yard
square kilometre (km ²)	x 0.39	square mile
hectare (ha)	x 2.5	acres
VOLUME		
cubic centimetre (cm ³)	x 0.06	cubic inch
cubic metre (m ³)	x 35.31	cubic feet
	x 1.31	cubic yard
CAPACITY		
litre (L)	x 0.035	cubic feet
hectolitre (hL)	x 22	gallons
	x 2.5	bushels
WEIGHT		
gram (g)	x 0.04	oz avdp
kilogram (kg)	x 2.2	lb avdp
tonne (t)	x 1.1	short ton
AGRICULTURAL		
litres per hectare (L/ha)	x 0.089	gallons per acre
	x 0.357	quarts per acre
	x 0.71	pints per acre
millilitres per hectare (mL/ha)	x 0.014	fl. oz per acre
tonnes per hectare (t/ha)	x 0.45	tons per acre
kilograms per hectare (kg/ha)	x 0.89	lb per acre
grams per hectare (g/ha)	x 0.014	oz avdp per acre
plants per hectare (plants/ha)	x 0.405	plants per acre

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